PRC Environmental Management, Inc.
120 Howard Street
Suite 700
San Francisco, CA 94105
415-543-4880
Fax 415-543-5480

November 12, 1993

Michael McClelland
Base Closure Team
Western Division
Naval Facilities Engineering Command
900 Commodore Drive
San Bruno, CA 94066-2402

Re: Radiological Survey of Investigation-Derived Waste by Chem Nuclear

Mr. McClelland:

This letter identifies PRC Environmental Management Inc.'s (PRC) concerns about the technical validity of the investigation-derived waste (IDW) radiological survey performed by Chem Nuclear, a Navy Radiation Affairs Support Office (RASO) subcontractor.

I. INTRODUCTION

During the week of October 18, 1993, Chem Nuclear was at Hunters Point Annex (HPA) to perform radiological screening of approximately 250 drums of IDW from Operable Unit (OU) I, OU IV, and Installation Restoration (IR) 18, stored in Building 810. The IDW will be evaluated in two phases. The first phase, a field survey to identify drums that exhibit elevated gamma count rates, has already been completed. The second phase will involve shipment and disposal of radiological IDW identified during Phase I. The IDW in the drums may contain radium-226 (^{226}Ra) and strontium-90 (^{90}Sr) in the form of both point source and diffuse material. It was generated during remedial investigations in the Industrial Landfill (IR-01), the Bay Fill Area (IR-02), the Submarine Base Area (IR-07), and the Waste Oil Disposal Area (IR-18). Each of these areas has been identified as containing, or having the potential to contain, ^{226}Ra or ^{90}Sr.

During Phase I IDW drum screening, Chem Nuclear:

- Weighed each drum.
- Measured the gamma exposure rate for each drum using a 2-inch by 2-inch sodium iodide (NaI) detector. The detector had been calibrated using cesium-137 (^{137}Cs) for peak gamma efficiency at 662 thousand electron volts (keV).
- Collected 10 soil samples from approximately 250 drums for laboratory analysis.

The results of field measurements and laboratory analyses completed for Phase I will be used to determine if the drums are eligible for disposal at a pre-approved site. Chem Nuclear will evaluate these results to determine if the IDW can be classified as low-level radioactive waste (LLRW) that exclusively contains ^{226}Ra and other naturally occurring radioactive materials (NORM).

In the past, the Navy used both ^{226}Ra and ^{90}Sr in radioluminescent markers. If the waste drums are found to contain ^{90}Sr or a combination of ^{226}Ra and ^{90}Sr, the Hanford, Washington, site may not accept them for disposal.

II. HPA RADIOLOGICAL SCREENING METHODS AND ASSUMPTIONS

To best serve the Navy, PRC would like to review all data produced by Chem Nuclear for the IDW screening. Screening methods and assumptions used by Chem Nuclear, based on observation of their work at HPA, presented three main concerns, as discussed below.

1. Gamma exposure rate measurements, without regard to energy, were used to identify IDW exhibiting elevated gamma activity

Since Chem Nuclear was contracted to screen drums for ^{226}Ra, the characteristic gamma energies associated with this radioisotope and its decay progeny should have been used to identify it during the survey. The detectors and methods used were not specific enough.

Measuring a specific gamma energy, or range of energies, associated with a particular radioisotope is important because it allows rapid determination of whether a particular gamma-emitting isotope is present. One simple screening method that could have taken advantage of unique gamma energies employs a time-integrated gamma count rate measurement of a selected range of gamma energies. The same NaI detector used by Chem Nuclear could be used for this measurement. Coupled to a single-channel gamma analyzer (SCGA), the NaI detector will more specifically survey for ^{226}Ra. SCGA uses one wide channel that covers several tens of keV, and adds the counts together from all energies within the channel. The use of SCGA effectively reduces the detected background count and increases sensitivity in the energy region, or channel, of interest. Once the relative activity of ^{226}Ra has been calculated, taking into account geometry effects, detector efficiency, and other factors, the exposure or activity, by weight, may be determined from the measured gamma flux.

Additionally, in-situ gamma spectroscopy, using a high-purity germanium (HPGe) detector, could have been used to evaluate selected drums for ^{226}Ra. Similar to SCGA, gamma spectroscopy relies on the selective identification of specific gamma energies emitted by a radionuclide. The emitted energies are like a unique fingerprint for a particular gamma-emitting radioisotope. In gamma spectroscopy, a spectrum is created from hundreds of adjacent, narrow channels that are electronically monitored to create an energy spectrum. Once the gamma spectrum is known, the relative activity for each nuclide can be calculated using methods similar to those used with SCGA.

It is unlikely that ^{90}Sr would have been detected using Chem Nuclear's survey methods or any of the suggested methods since this radioisotope is a pure beta emitter. It would not have been detected during the exposure rate survey unless it was present in large amounts very close to the interior surface of the steel drum. The high-energy beta particles produced by ^{90}Sr can interact with dense materials like steel

to generate polyenergetic bremstralung rays that are similar to x-rays and low-energy gamma rays. The bremstralung rays would be detected by the NaI detector if they had energies greater than about 100 keV.

2. Few soil samples were collected

Chem Nuclear collected only 10 soil samples from the IDW areas during the Phase I visit. We feel that this is too few samples to accurately characterize 250 drums. The implied intent of the sampling was to characterize all 250 drums for radiological content. PRC believes that if Chem Nuclear had used SCGA or in-situ gamma spectroscopy, the results of screening for ^{226}Ra would have been more certain and may have provided support to justify the few samples that were collected to characterize all of the drums.

Chem Nuclear has not provided technical justification for the limited number of samples that they collected. They could have justified the number of samples collected if there were a normal, gaussian distribution of radiation levels associated with the drums. A probability value could then be assigned to the uncertainty associated with a false nondetect or false positive detection.

3. Standard operating procedures were not provided

Chem Nuclear was not able to provide any standard operating procedures that detailed the survey methodology used in the field or the methods to be used to evaluate and reduce the data collected.

Based on these concerns, PRC believes that Chem Nuclear did not use the proper instrumentation required to perform the survey. It is not clear that the contractor had a documented, defensible plan to be implemented for IDW screening. The survey plan was very general and, in our opinion, not specific enough to provide a definitive evaluation of the IDW for both beta and gamma-emitting radioisotopes. Therefore, before any IDW is shipped for disposal, it would be prudent to closely evaluate the results of the survey performed by Chem Nuclear. Only after the survey results have been reviewed for their technical accuracy may a judgement be made regarding the overall validity of the survey.

If you have any questions, please do not hesitate to call me at (415) 543-4880.

Sincerely,

David Martinez
Assistant Project Manager

cc: Gary Welshans, PRC
Jim Sickles, PRC
Joel Cehn, CHP
file